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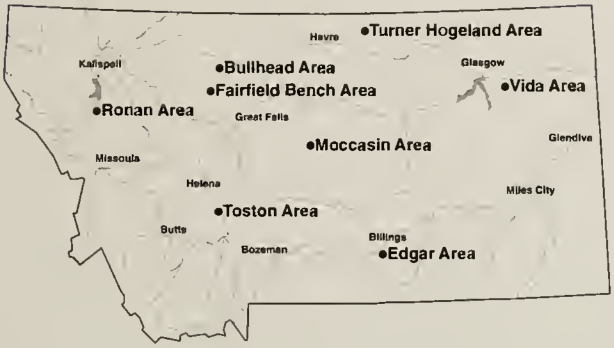
Monitoring

Montana's Ground Water Monitoring Programs

All of us expect the water we drink to be good. Most rural homeowners and many towns and cities throughout Montana rely on ground water for household and other water supplies. Until recently, ground water quality has been taken for granted. Protecting the quality of Montana's ground water and assuring its availability are becoming increasingly important. Consequently, protecting ground water from fertilizers and pesticides has become a state and national issue.



Locations of existing permanent monitoring sites (MDA, 1993).

Monitoring is the collection and analysis of water and other samples for agricultural chemical residues. Monitoring may be conducted if sufficient scientific data is available to reasonably suspect the presence of a pesticide or fertilizer in ground water. Monitoring is conducted on a statewide and site-specific basis. The Montana Department of Agriculture (MDA) and the Montana Department of Health and Environmental Sciences (MDHES) are required by law to conduct ground water monitoring to detect the presence of agricultural chemical residues.

The MDA conducts *three types* of monitoring programs: ambient, follow-up and compliance monitoring.

Ambient (background) Monitoring

Ambient (or background) monitoring is conducted by the MDA and other federal, state and local agencies to assess the occurrence of pesticide or fertilizer residues in ground water. Ambient monitoring is often a cooperative effort among the various technical and regulatory agencies involved in ground water. The results obtained from ambient monitoring also provide statewide baseline water quality data which can be used to evaluate or observe any changes or trends in the state's ground water quality. There are three types of ambient monitoring:

1. **General Statewide** General statewide ambient monitoring is conducted on a routine basis. When the MDA started this monitoring in 1984, the selection of monitoring sites was primarily based on locating shallow wells (less than 50 feet deep) within a coarse or sandy soil complex. The MDA then analyzed water samples for pesticides known to have been used on crops grown in that area. While this allowed the MDA to concentrate its limited resources in what it considered to be vulnerable areas, the narrow focus resulted in defining a worst-case situation, rather than what was occurring statewide. In 1989, the data were summarized and revealed that of the 105 wells tested, 23 contained residues of seven different pesticides. Carbon, Jefferson, Richland, Sheridan, Teton and Yellowstone counties had positive detections. The pesticides detected in the wells included the herbicides atrazine, 2,4-D, dicamba, MCPA, picloram and the insecticide Aldicarb. All but one of the detections were well below the Maximum Contaminant Level (MCL) or health advisory levels and presented no immediate drinking water health risk. The one detect above the health advisory was MCPA which was found at 5.5 parts per billion (ppb) (health advisory= 4.0 ppb). Follow-up sampling of this well revealed no residues one year after the initial positive detection (1986). Follow-up sampling of the other wells with positive detections has shown that pesticide residues have disappeared. Several wells continue to show minute amounts of several herbicides (i.e., 2,4-D, picloram), but the residue levels continue to decline and none of the wells are used as a drinking water source.

Since 1989, the MDA has been less selective in terms of choosing to sample only wells less than 50 feet deep and constructed in coarse soils. Rather, the MDA has concentrated more on crop types using pesticides that the EPA has identified as having leachable characteristics. The MDA has sampled rural domestic wells in 39 of Montana's 56 counties. Since 1989, low level detections of 2,4-D, aldicarb, picloram, and atrazine have been found. The positive detections of these compounds occurred in: Blaine, Lake, Lewis and Clark, McCone and Missoula counties. All but one of the pesticides detected were well below the MCL or health advisory levels. The pentachlorophenol detect that exceeding the MCL of 1 ppb came from an ungrouted, hand-dug 20-foot well. Fortunately, the individual residing there was not using the well for drinking water, but it was recommended that he not use it for showering or cooking as he had done in the past.

The number and level of pesticide detections in Montana's ground water has not been great. However, the diversity of hydrogeological conditions in which pesticides have been found indicates the need to continue an active statewide ground water monitoring program.

2. **Permanent Monitoring Sites** Permanent monitoring sites are long-term monitoring wells located in major crop production areas. The sites are used to determine the presence of ground water impairment by specific agricultural chemicals associated with irrigated small grain, dryland small grain, irrigated sugar beets and irrigated seed potatoes.

Six of the monitoring well sites were developed during 1989-1990, with Toston and Moccasin being developed in 1992 and 1993. The original six wells were monitored on a quarterly basis for the first 2 years and at least twice a year since then. The two newer wells were integrated into the existing sampling schedule. Since 1993 was such a high moisture year, it is likely the wells will be sampled quarterly for at least the next year to see what impact (if any) the additional moisture has on water table levels.

Bullhead site The Bullhead well is located in a confined aquifer, so water quality analyses from it are indicative of practices occurring in a recharge area not immediately above or surrounding it. No pesticides have been detected at the Bullhead site.

Edgar site This site is in an area of historical detection of carbamate pesticides. Aldicarb sulfone, a metabolite of aldicarb, was found below the detection limit in 1991. The site is lithologically sensitive to ground water contamination, and ground water levels are strongly influenced

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by infiltrations of irrigation water and leakage from irrigation canals.

Fairfield site The infiltration of irrigation water and leakage from irrigation canals strongly influences ground water levels at the Fairfield site. The several 2,4-D detects at the Fairfield site are probably due to pesticide application up-gradient of the site and the subsequent ground water transport of the contaminant in the down-gradient direction.

Ronan site Ground water levels at Ronan fluctuate in direct responses to recharge from precipitation, on-farm irrigation and leakage from irrigation canals. Nitrate concentrations are low and while no pesticides have been detected since 1990, a previous investigator found aldicarb sulfoxide at the site in 1988.

Toston and Moccasin site These sites are in areas of potato/small grain/hay crop rotations and small grain crops, respectively. No pesticides have been detected at either site to date.

Turner site This site is geologically sensitive to aquifer contamination, but since much of the surrounding area is in the Conservation Reserve Program, little or no pesticides are being applied at this time. No pesticides have been detected at the site, but the nitrate concentrations are elevated.

Vida site Lithology at the Vida site, consisting of silty clayey glacial till, interbedded with gravel and thin coal beds, suggests very low susceptibility to pesticide contamination and movement. Yet a low level of 2,4-D was detected once and picloram was detected on two occasions. After recharge in 1991, no pesticides were detected. The pesticides probably gained entrance to the system through vertical cracks in the clayey glacial tills. Results from the experience challenge traditional ideas that clay lithology constitutes a "safe" environment for pesticide application.

3. **Special Projects/Basins/Watersheds** Special projects/basin/watersheds is monitoring conducted for special projects (public water supply), and/or specific basins or watersheds (Helena valley aquifer). Special project type monitoring is often conducted on a cooperative basis with other water resource/public health agencies.

The MDA, in cooperation with MDHES, sampled 28 rural community water supplies during 1991 and 1992. The criteria used in selecting those sampled were:

1. the system had to serve 25 people or more,
2. the drinking water came from a ground water source, and
3. the site had to be located in a rural environment.

The sites selected turned out to be several small communities using ground water as a public water supply and a number of rural schools or schools located in a rural community. Several pesticides were detected at low levels at several of the sites. The information was turned over to the Drinking Water Section in the MDHES- Water Quality Bureau for further action.

Follow-Up Monitoring

Follow-up monitoring is either in response to a complaint or a prior detection in order to *confirm* the presence of an agricultural chemical. Monitoring of additional surrounding wells is usually completed to help confirm the presence and indicate any migration of the pesticide or fertilizer residue.

Compliance Monitoring

Compliance monitoring is to determine compliance with an order, agreement or specific management plan (SMP). It is usually performed in response to a spill or misuse, or if there is a significant *probability* of a pesticide or fertilizer entering ground water.

Quality Assurance/Quality Control

The MDA follows an Environmental Protection Agency (EPA) approved quality assurance (QA) and quality control (QC) program. Quality assurance is a management function (policy) that assures that th quality of the monitoring program meets the required standards within a stated confidence. Quality control establishes detailed standards such as precision, accuracy, representativeness, completeness, and comparability. Quality assurance ensures that the QC function is being performed as specified. In order to establish a QA/QC program, MDA has developed the *Montana Laboratory Pesticide Quality Assurance Project Plan 1991*. The Plan meets the requirements of the EPA's "Pesticide State Management Plan Guidance for Ground Water Protection".

Monitoring Results

The results of ground water monitoring conducted by the MDA are maintained in a ground water data base in the Helena office. In addition to the data base in Helena, the monitoring program results are incorporated into the Ground Water Information Center (GWIC) located at the Montana Bureau of Mines and Geology. The GWIC manages a statewide ground water data base that contains well logs, lithology, water quality parameters (organic and inorganic) and site information on all recorded wells in the State. The GWIC data base contains the Minimum Set of Data Elements for Ground Water Quality established by EPA to improve the collection, accessibility, and use of ground water information by standardizing the data base elements.

The monitoring results of other agencies involved in ground water are stored in other data bases. The United States Geological Survey (USGS) uses several data bases to store ground water and monitoring data such as the State Water Use Data System (SWUDS) and the Water Quality Data Processing System (QWDATA). Eventually, all data is transferred to the WATSTORE system and then to EPA's STORET database. The public has access to all monitoring data once they are entered into STORET/GWIC. Under provisions of a Memorandum of Understanding, the MDA and MDHES exchange all ground water monitoring results.

Positive Detections

All positive detections of pesticide residues in ground water must be reported to the MDHES. The MDA is required to report all *positive* drinking water detections to MDHES within 48 hours of receipt of analytical results, except for detections from public water supplies or results that meet or exceed primary drinking water standards, which must be reported immediately upon receipt of positive analytical results.

Another consideration when monitoring ground water for specific pesticides is the possible presence of degradates of the compounds of interest. Pesticides can degrade to compounds that may be as toxic or more toxic than the parent compounds. Detection of these metabolites or degradation products in ground water is evidence that the parent compounds are leaching. If possible, analytical methods are selected to detect degradates as well as the parent compounds. Examples of pesticide degradates include aldicarb sulfone, aldicarb sulfoxide (from aldicarb), disulfoton sulfone, disulfoton sulfoxide (from disulfoton), and ethylene thiourea.

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The programs of the Montana Extension Service are available to all people regardless of race, creed, color, sex or national origin.

Issued in furtherance of cooperative extension work in agriculture and home economics; acts of May 8 and June 30, 1914. In cooperation with the U.S. Department of Agriculture, Andrea Pagenkopf, Associate Vice Provost for Outreach and Director Extension Service, Montana State University, Bozeman, Montana 59717.

Funding provided by the Montana Agricultural Chemical Ground Water Protection Act and Fertilizer Checkoff. Additional information may be found in the General Agricultural Chemical Ground Water Management Plan (GMP).